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# Finer, Better Lime, Please!

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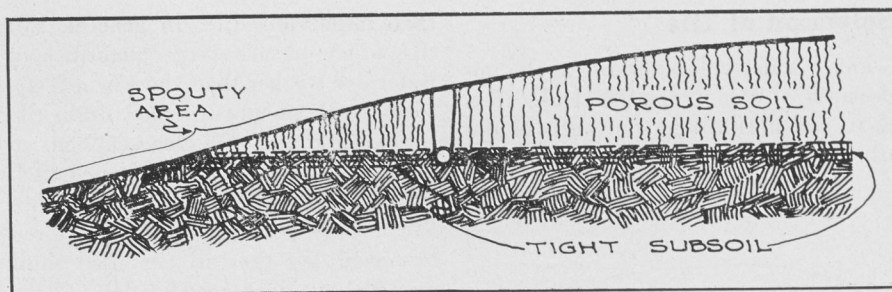
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Seepy ground on hillsides should be drained by intercepting the water some distance above the "spouty" area, since wet spots along hillsides usually are caused by an impervious layer of soil which stops downward water flow.

underside. Oftentimes pieces of broken tile can be used to cover small openings on the tops or sides to prevent soil from getting into the tile.

The importance of laying the tile and covering with a few inches of earth (blinding) as soon as the trench is completed to grade cannot be overstressed. Caving of the banks is always likely.

### Maintenance of the System

**Open ditches** should be kept free from tree and weed growth which slow down the velocity of the stream and result in excessive silting. Logs, brush, old fencing and other debris should be kept cleared from the channel. Controlled pasturing of the berm and spoil-

banks will help prevent tree and weed growth and will cause no serious difficulty if hogs are not used in the pasture.

Unless obstructions are kept out of the channel, silting will not only diminish the capacity of the ditch, but will submerge tile outlets emptying into the ditch.

**Tile drains** to be effective must be kept open. It seems to be the common impression of landowners and others that once tile are installed they should continue to function indefinitely without any attention. The chief difficulty is that of keeping the outlets in good condition. Root growth may cause tile stoppage. Any hole or "cave-in" over the tile line indicates that a tile is out of position or has broken. This damage should be corrected at once or else the line above will become filled with silt.

## ★ FINER, BETTER LIME, PLEASE!

**D**URING THE PAST 4 years, Iowa farmers have used over 5 million tons of ground limestone, approximately four times as much as in any similar period prior to the AAA Conservation Materials Program. This limestone is helping materially in producing record crops on several million acres of good crop land. But many million acres still need to be mobilized for maximum production by liming.

Now more than ever before, we need to get the quickest results and the greatest efficiency possible from the limestone we use. This means, first of all, using limestone that is finely ground — limestone that contains a large percentage of "dust." Unfortunately, much of our ground limestone is too coarse for maximum war-time value, as our study here shows.

### Fineness Speeds Benefits

Many ground limestones contain particles that vary from dust in size to particles that are the size of gravel. When limestone is applied to the soil, the fine particles dissolve readily and combine with the soil acids to neutralize them and to furnish calcium to the

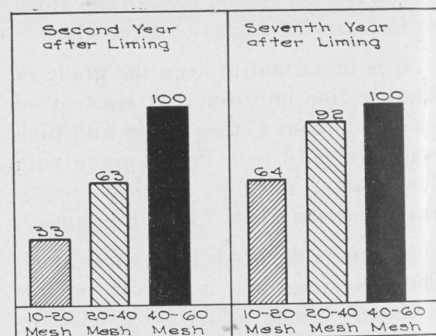
plants. The coarse particles, however, dissolve very slowly and many of them will not be of any value in the soil for a number of years after application.

It is very important, therefore, to determine the fineness of any ground limestone if we are to know its value. Fortunately, this is easily done by passing a small sample of the ground limestone over a set of small screens or sieves. Usually three different sized sieves are used in our screen analysis. The coarsest of these sieves has eight openings per linear inch and is known as an 8-mesh sieve; the finest sieve has 60 openings per inch, and is referred to as a 60-mesh sieve.

The actual size of the particles obtained from passing a ground limestone sample over these sieves is shown in the small circles in the accompanying illustration. By knowing what percentage of a sample of limestone is made up of particles of these different sizes the value of the limestone during the first few years after it is applied to the soil can be easily calculated.

Particles held on an 8-mesh sieve have relatively little value in correcting soil acidity during the first few years after application, whereas the particles

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Relative value of limestone particles of different sizes in increasing yield of alfalfa on Tama silt loam. (The mesh size of 40-60 is taken as 100%.)

that pass a 60-mesh sieve are practically all available during the first few months after application. It is for this reason that the fineness specification usually recommended, and that used in the AAA program, requires that at least 90 percent of the limestone particles should pass through an 8-mesh sieve.

### Fine Lime Boosts Alfalfa

The benefits that are obtained by using limestone that is finely ground are

The average screen analysis of 182 samples of ground limestone, compared to that of the 25 coarsest and the 25 finest samples.

Particle size	Percentage in each size group		
	25 coarsest samples	25 finest samples	Av. of all samples
Held on 8-mesh	33.0%	6.0%	18.0%
8-20 mesh	30.6%	19.0%	27.2%
20-60 mesh	19.0%	24.8%	23.6%
Passing 60-mesh	17.4%	50.2%	31.2%

well illustrated in some results we obtained with alfalfa on Tama silt loam soil. Three different grades of limestone were compared. The limestone in all cases was thoroughly disked into the soil in early spring before seeding the oats and alfalfa.

When the alfalfa hay was harvested the following year, it was found that the 40-60 mesh limestone, the finest grade used in this experiment, had increased the yield of alfalfa by an average of 1.69 tons per acre; whereas the coarsest grade, the 10-20 mesh limestone, had increased the yield only 0.58 tons per acre.

These results are shown on a relative basis in the accompanying bar graph. The 10-20 mesh limestone was only 33 percent as effective as the 40-60 mesh material. With time, of course, the coarser particles gradually become more available. Even after 7 years, however, the 10-20 mesh limestone was only 64 percent as effective as the finer grade.

### Score Card for Fineness

On the basis of such data as reported here for alfalfa, we have prepared a score card or rating for calculating the value of any ground limestone on the

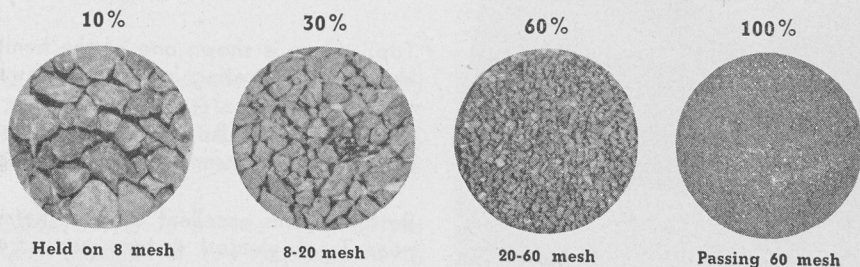
basis of its screen analysis. By the use of this score card it is possible to determine about what percentage of any limestone will be available in the soil in the first year or two after application, and thus to compare ground limestones from different sources.

The values of this score card are given in the illustration showing size of particles. Note that the portion of the ground limestone which passes through a 60-mesh sieve is considered to be 100 percent available. This material is often referred to as "dust." The portion of the limestone that is held on the 8-mesh sieve, however, has a rating of only 10 percent availability during the first 1 to 3 years after application.

Other states such as Illinois, North Carolina, Ohio, Pennsylvania and West Virginia have also established ratings for evaluating limestones of different degrees of fineness. In general, there is good agreement among the various ratings. The Illinois rating shows higher values for coarse limestone, but it is based on a 5-year rather than on a 1 to 3-year period. The Ohio rating which is based on considerable experimental work gives slightly lower credit to coarse limestone than does the Iowa rating but is in general in good agreement with it.

### Availability of Limestone Particles of Different Sizes

Percent Availability in 1-3 Years



### Much Lime Too Coarse

During the past season, 182 samples of limestone were obtained from different parts of the state in order to determine the quality of limestone now being sold to Iowa farmers. A weighed sample from each ground limestone was poured over the different size sieves in order to find out the proportion of coarse and fine particles. Tests were also made of the purity or neutralizing value of each limestone.

The results obtained show that the ground limestones now used in the state vary greatly in agricultural value, and that many of them are of relatively poor quality. As an average for all samples, 18 percent of each sample was too coarse to pass an 8-mesh sieve and only 31.2 percent was sufficiently fine to pass the 60-mesh sieve. Moreover, only 38 percent of all samples met the commonly accepted standard that at least 90 percent of any ground limestone should be fine enough to pass an 8-mesh sieve.

As shown in the accompanying table, the 25 coarsest samples showed an average of 33 percent of material too coarse to pass an 8-mesh sieve and only 17.4 percent fine enough to pass through a 60-mesh sieve. This is in striking contrast to the values obtained for the 25 limestones that had been most finely ground. The finer limestones contained nearly three times as much fine material (passing through 60-mesh sieve) and only one-fifth as high a proportion of coarse particles as did the 25 coarsest samples.

If we compare the value of the coarsest and finest samples on the basis of the relative efficiency of the different particle sizes shown in the illustration, we find that where it would take 2 tons of the most finely ground limestones to grow a good crop of alfalfa on a given soil during the first year or two after liming, it would take 3½ tons of the coarsely ground limestones to give the same results.

### Purity of Limestone

The purity or neutralizing value of limestones is also an important factor in determining their agricultural value. The neutralizing value of limestones is usually expressed as "percent calcium carbonate equivalent," or "% C. C. E." Pure calcium limestone gives a C. C. E. value of 100 percent.

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path to the outgoing path without going through the appliance.

If two bare wires are rubbing, they may be insulated from each other by wrapping each with friction tape. If the electricity is jumping from one path to the other within the plug, the plug can easily be taken apart and studied. First, one must note that the two paths are separate. Sometimes just a little wisp of wire may be touching the other side. Within the plug, especially in an iron plug, there are little grooves where the wires should be. There are always two screws or terminals in every plug to which the wires of the cord are attached. The wire ends should be twisted and fastened to these — one screw is meant for each electrical path.

The greatest difficulty is to put the wire around the screw properly. This can be done most easily and efficiently as shown in the accompanying illustration.

## Finer, Better Lime, Please

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In our study of the 182 limestones obtained from different parts of the state, we found that they averaged 83.0 percent C. C. E. The 25 poorest samples, however, averaged only 64.3 percent whereas the 25 best samples averaged 96.3 percent equivalent. Because of this difference in neutralizing value it would take exactly 3 tons of the poorest to be equal to 2 tons of the best.

## Conclusions

The marked demand for and the rapid increase in the use of limestone during the past few years probably accounts for the tendency toward a lowering of standards. This is unfortunate at the present time. We need to increase the amount of limestone used on Iowa farms, but we also need to get the greatest returns possible in terms of bushels of corn and tons of alfalfa from every ton of limestone used.

The bottlenecks in production are largely due to shortages of labor and transportation. It takes the same amount of labor and transportation facilities to produce and haul limestone that is of low quality, or is so coarsely ground that much of it will not become available in the soil during the next few years, as it does to produce, haul and

spread limestone that is of high quality and quickly available in the soil. Moreover, the particles of limestone that are so coarse that they remain in the soil practically unchanged for several years are making little contribution to food production and the war effort.

Our slogan for the present war production program should be "Use more limestone of better quality to maximize food production."

## Oat Seeding Rate

WITH the price of seed oats high and a large demand for oats to feed, Iowa farmers may well consider carefully the amount of oats per acre that they sow next spring.

Some information on rate of seeding — its effect on yield, lodging, date of ripening and the like — has been obtained during the past 2 years in experiments conducted by the Iowa Station on the Agronomy Farm at Ames.

Tama oats have been seeded on Clarion and Webster soils during those 2 years at rates of seeding ranging from 1 bushel to the acre to  $4\frac{1}{2}$  bushels. In 1942, the best yield was obtained from a seeding rate of  $2\frac{1}{2}$  bushels to the acre. In 1943 the best rate was 3 bushels.

From the tests during these 2 years, it appears that there is not any advantage in seeding more than 3 bushels to the acre.

In both years there seemed to be no connection between the rate of seeding and the height the oats grew, how they stood up or lodged. There seemed to be no connection in 1942 between the rate of seeding and bushel weight of the oats harvested, but in 1943, in a less favorable growing season (for some reason which is not known), the bushel weight increased from 30 pounds at the  $1\frac{1}{2}$ -bushel rate to 34 pounds for the  $4\frac{1}{2}$ -bushel rate.

In 1943 the yield per acre from 1 bushel of seed was 68 bushels to the acre and for the other rates as follows:

$1\frac{1}{2}$  bushels of seed — 70 bushel yield;  
2 bushels — 72 bushels to the acre;  
 $2\frac{1}{2}$  bushels — 74; 3 bushels — 76;  
 $3\frac{1}{2}$  bushels — 76; 4 bushels — 74;  
 $4\frac{1}{2}$  bushels — 73.

In 1942 there was no increase in yield from seedings of  $2\frac{1}{2}$  bushels to the acre up to  $4\frac{1}{2}$  bushels. In fact, as in 1943, the yield dropped off from seeding rates higher than  $2\frac{1}{2}$  bushels to the acre.

## New Seedling Potato

A new seedling potato named Sequoya has been developed and introduced by the United States Department of Agriculture which appears to have a lot of resistance to injury by leaf hopper.

If such a variety adapted to Iowa can be found, it will be a great improvement over the varieties we have now, for it will eliminate most of the four or five sprayings that are necessary to avoid hopper injury.

The Sequoya, Irish Cobbler and Early Ohio were planted adjoining a bean patch to insure plenty of hoppers in a field test by the Iowa Station in Iowa last year. Except for one spray with lead arsenate to control potato bugs, the potatoes were left unsprayed throughout the season. The foliage of the Sequoya remained green with scarcely a suggestion of hopper burn while the Cobblers and Ohios were severely burned.

Sequoya yields well in northern Iowa and is an attractive potato. But it matures 2 to 3 weeks later than the Cobbler which is a serious objection.

Further crosses between the Sequoya and an earlier variety will be made the coming year with the hope of combining immunity to hopper burn and early maturity.

## Rate to Plant Soybeans

If you plant soybeans in rows about 32 inches apart, then the rate of seeding for maximum yields with seed of high germination need not be more than 1 bushel to the acre.

This is the conclusion reached after 4 years of testing five varieties of soybeans seeded at rates ranging from 0.6 bushel to 2.2 bushels to the acre. In these tests conducted on the Agronomy Farm of the Iowa Station at Ames, the yields from the different rates varied only slightly, up to seeding rates of 1.8 and 2.2 bushels to the acre. These heavier rates gave significantly lower yields.

The heavier rates of seeding also showed more lodging. In 1942 with the early frost, the badly lodged beans were damaged more than those that stood up well because lodging retarded maturity. Therefore, too heavy rate of seeding soybeans may cut down the quality as well as the yield.